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from the cells of the leaf without any well-defined mycelium, and form a continuous olive brown or green stratum on the lower surface of the leaf, beginning with well-defined brown spots which soon spread and occupy the entire leaf—mostly the young terminal ones.

REVIEWS OF RECENT LITERATURE.

Farlow, W. G., and Seymour, A. B.—*A Provisional Host-index of the Fungi of the United States.* Part I, Polypetalae, pp. 1–52, Cambridge, 1888. Part II, Gamopetalae-Apetalae, pp. 53–134, Cambridge, September, 1890. Part III, pp. 135–220, Cambridge, June, 1891.

The issue of the third part of the above work, containing the endogens, cryptogams, and animals, and an addenda, together with an index to all three parts, finishes this most valuable and laborious work. As completed it contains 220 octavo pages. About 85 names on an average, including synonyms, are given on each page. The work will be a necessity to every American mycologist, and, aside from its direct value as a host-index, will be of very considerable worth as a guide to the synonomy of the American species of fungi. In accuracy and completeness it is almost without equal among mycological publications. It is to be wished, however, that a reference could have been given after each name of a fungus to one or more works in which it was reported on the host in question. It is likely that descriptions of some of the species will be troublesome to find. A title page for all three parts would also be a valuable addition.

Some interesting facts are revealed by a study of the index. The number of species reported on some genera of trees is truly astonishing. The family Cupuliferæ requires 24 pages, and these will probably average no less than 100 names ot fungi to a page. A most striking fact is the very small number of species reported on Algæ. Only two species, both *Chytridii*, are given. These occur on four species of Algæ. In Europe, on the contrary, where the algal parasites have been carefully studied, their number is very considerable, probably aggregating several hundred species.

Botanists everywhere would no doubt be very grateful if the authors of the "Host-index" could be induced to prepare the converse work, namely, a list of the species of fungi of the United States with their host plants.—W. T. Swingle.

Fischer, Dr. Alfred.—*Phycomycetes.* Rabenhorst's Kryptogamenflora. I Band. IV Abtheilung: Pilze; 45, 46 and 47 Lieferungen, pp. 1–192. Leipzig. Ed. Kummer, 1892.

Part. IV of this important work begins with No. 45. Part III on Discomycetes by Dr. Rehm still lacks eight numbers of completion, but the whole of Dr. Fischer's manuscript being in hand, the publisher has wisely concluded to begin publication at once. The lamented DeBary was to have written this volume, and it is a matter for congratulation that his mantle has fallen upon a competent successor.

In Winter's system (Pilze I, p. 32) the Phycomycetes are divided into two classes, Zygomycetes and Oömycetes. The position of the Chytridiaceæ remains doubtful and the Entomophthoreæ, now known to belong to Zygomycetes, are classed under Basidiomycetes. Since the appearance of this first volume so much new light has been thrown on the relationships of fungi that no excuse is necessary for departure from the old views, but some of the changes, *e. g.*, those under Peronosporinæ, will undoubtedly lead to criticism.

The name Phycomycetes, *i. e.*, alga-fungi, indicates the many-sided relationships of the group with certain algæ, *e. g.*, Siphoneæ (Vaucheria, etc.), not only in the possession of a nonseptate vegetative body, sexual organs, and swarm spores, but also in the aquatic life of many sorts. The nonseptate character of the mycelium is especially constant, so that the name Siphomyces, *i. e.*, tube fungi, might properly be used for the whole group, corresponding to the term Siphophyces applied to the parallel group of algæ. Cohn united under the name Siphomycetes the three orders Peronosporeæ, Saprolegnieæ, and Chytridiaceæ and set up the Zygomycetes (Mucorineæ, etc.) as a group parallel to the Zygophyceæ (Conjugateæ). In Cohn's system the Phycomycetes were therefore split into two groups, Zygomycetes and Siphomycetes. Sorokin uses the term Siphomycetes as synonymous with Phycomycetes, in the sense already explained, and although the author thinks Siphomycetes a better name for the group than Phycomycetes he considerately refrains from disturbing the well-established usage. However, it is not simply a question of names, but one of widely differing views as to relationships. De Bary in his Comparative Morphology and Biology puts Peronosporeæ (Ancylisteæ and Monoblepharis included), Saprolegnieæ, Mucorineæ, and Entomophthoreæ at the beginning of his great Ascomycetous series; but he treats the Chytridiaceæ as a group of doubtful position in the system, although recognizing their dependence on these Phycomycetes. Indeed, the disposition of the Chytridiaceæ is the weak point in all previous classifications. So far, all mycologists agree that Peronosporeæ, Saprolegneæ, Mucorineæ, and Entomophthoreæ are genuine Phycomycetes, but some do not regard the Chytridiaceæ as a natural group, *e. g.*, Zopf would separate the Synchitreæ from the Eu-mycetes on account of their plasmodial vegetative body, and would consider them as a special group related to Myxomycetes. In Saccardo's Sylloge (Vol. VII), the Chytridiaceæ are indeed included within the customary limits of the Phycomycetes, but are looked upon as degenerated forms. Brefeld in Heft viii regards the Chytridiaceæ as degenerate Phycomycetes in which the vegetative body is reduced more and more until it disappears entirely in the formation of a sporangium. Thus, according to Brefeld and others, Olpidium represents the final member in a degeneration which began with Peronosporaceæ. The author's view is just the opposite of this. He regards Chytridiaceæ as a natural group and the simplest and earliest in point of time, *i. e.*, as the starting point of the whole great series which ends in the Oömycetes with richly branched mycelium.

Concerning disputed relationships he has the following: The Olpidiaceæ have much in common with the zoösporous Monadineæ, but the differences are still greater. One principal difference consists in the manner of taking food. In the Monadineæ this takes place through the active amœboid movements of the plasmodium by which solid substances are commonly taken up. In the Myxochytridineæ the amœboid movements of the naked vegetative body are always feeble or wholly wanting, and the taking up of solid bodies does not occur. Consequently while the Monadineæ take their food like the Myxomycetes, in the Myxochytridineæ there is only an absorption of dissolved food as in the genuine fungi. In connection with this stands the extrusion of undigested food balls, something which, of course, does not occur in the Myxochytridineæ. Together with the accompanying physiological differences due to the different manner of taking food, there are also important purely morphological differences. In a number of zoösporous Monadineæ (Aphelidium, Plasmodiophora) the amœboid body breaks up into spores without previous formation of membrane, but in those forms in which a wall is previously formed the swarm spores escape from the cyst at indefinite places, *i. e.*, there is no special canal for escape. The contrary is true for all the Myxochytridineæ except Sphærita. Finally it should be emphasized that not rarely the actively amœboid body becomes a genuine plasmodium, through the blending of several amœbæ, while genuine plasmodia are wanting in Myxochytridineæ, with the possible exception of Rozella. The relationship of the Myxochytridineæ with the Monadineæ is to be recognized, but on the other side there is also to be noted in the described departure a step toward the fungi. It is especially the Holochytriaceæ which show a transition into genuine mycelium. Forms like Myzocytium belong with the Myxochytridineæ on account of their holocarpal development, but differ in the elongated vegetative body, surrounded from the first by a membrane, which, by its branching, takes on a mycelial character.

Morphologically the Zygomycetes and Oömycetes can be very easily united to these Holochytriaceæ, as a further development, with a richly branched, eu-carpal, mycelial vegetative body.

The family of the Sporochytriaceæ with mycelial haustoria appears to me to join on to the Hyphochytriaceæ above. Among the Monadineæ, *Colpodella pugnax* shows a similar development but is distinguished by the absence of mycelium and the much later following wall formation. Finally the family of Hyphochytriaceæ which joins on to the Sporochytriaceæ (Polyphagus) is continued into Protomyces and the Ustilagineæ.

Under Phycomycetes the author includes all plants having the following characteristics:

Vegetative bodies one-celled, only forming septa during the production of reproductive organs, or when still older, sometimes unbranched and changing wholly into a sporangium (holocarpal), sometimes a richly branched mycelium with special reproductive organs (eu-carpal). Nonsexual reproduction by swarm spores or non-motile spores; sexual by zoöspores or oöspores.

The following is Dr. Fischer's classification:

PHYCOMYCETES (Siphomycetes).

I. Series. Archimycetes (Chytridiaceæ).
II. Series. Zygomycetes.
III. Series. Oomycetes.

Under the first series he gives the following subdivisions and family characters.

1. Order. Myxochytrideæ.

1. Family. Monolpidiaceæ (Olpidiaceæ).

The entire vegetative body changing holocarpally into a single spherical or elongated zoösporangium or one resting spore. Sexuality observed in one case.

2. Family. Merolpidiaceæ (Synchytriaceæ).

The entire vegetative body splits up holocarpally into a number of sporangia and produces a roundish or long one-rowed sporangial sorus. Resting state either a heap of resting spores, cystosori, or single resting spores, which arise from the entire undivided vegetative body or single parts of it.

2. Order. Mycochytridinæ.

1. Family. Holochytriaceæ (Ancylistaceæ).

Vegetable body tubeform or vermiform, unbranched or with short side branches, dividing by cross septa into a number of members, all of which change into reproductive organs (sporangia, oögonia, antheridia). Strictly holocarpal and monophagous, always intramatrical.

2. Family. Sporochytriaceæ (Rhizidiaceæ, Polyphagaceæ).

Vegetative body consisting of two parts, a spherical strong growing swarm spore, and a tenuous, thread-form, often very delicate, mycelial part. The ball-shaped part grows into a single sporangium, or into a single resting spore. Resting spores also develop in another manner from the mycelial part, or by the copulation of two plants. The mycelial part always perishes after one fructification, *i. e.*, it is strictly monocarpal, but also eu-carpal. There are two subfamilies, Metasporeæ, and Orthosporeæ.

3. Family. Hyphochytriaceæ (Cladochytriaceæ).

Vegetative body, a more or less branched and originally one-celled mycelium, which forms simultaneously a great number of terminal and intercalary swellings, and out of those zoösporangia or resting spores; eu-carpal, but mostly monocarpal; not perennial. Sexuality wanting.

Under the second series he gives:

1. Order. Mucorinæ.

1. Suborder. Sporangiophoræ.

1. Family. Mucoraceæ.

The cross wall which separates the stalk from the sporangium arches into the latter and projects as a columella, often far out. Zygospores naked, or only enveloped by a loose mycelial tissue, never inclosed in a compact receptacle and forming a fruit body. Three subfamilies, Mucoreæ, Thamnidieæ, and Piloboleæ.

2. Family. Mortierellaceæ.

Sporangium without a columella, with gelatinizing membrane. Zygospores single and completely inclosed in a receptacle (carposporium) like a small tuber.

2. Suborder. Conidiophoræ.

1. Family. Chætocladiaceæ.

Conidia single, spherical, in groups on the middle swollen part of the last branches of the conidiophore, the ends of the same remaining tenuous and sterile. Zygospores naked between the straight gametes.

2. Family. Cephalidaceæ.

Conidia in chains on the spherical-headed, swollen branch ends (sterigmata) of the unbranched conidiophore. Zygospores naked on the crown of the tongs-like gametes.

2. Order. Entomophthorinæ.

1. Family. Entomophthoraceæ.

With the characters of the order, *i. e.*, Mycelium mostly parasitic in living animals, rarely in plants, or saprophytic, richly branched, often falling into pieces, at first one-celled. Nonsexual reproduction by conidia which are delimited on the end of unbranched threads growing out of the substratum and thrown off when ripe, *i. e.*, no special conidiophores. Zygospores on the mycelium.

Under the third series he gives:

1. Order. Saprolegninæ.

1. Family. Saprolegniaceæ.

Antheridia applied to the oögonium like accessory branches, pushing fertilization tubes into the latter.

2. Family. Monoblepharidaceæ.

Antheridia with spermatozoids.

2. Order. Peronosporinæ.

1. Family. Peronosporaceæ.

With the characters of the order, *i. e.*, mycelium parasitic in the interior of living plants, richly branched, polycarpal. Nonsexual reproduction by swarm spores or conidia, mostly with specially formed conidiophores breaking out of the substratum. Oögonia always one-celled, with a remnant of unused protoplasm (periplasma). Antheridia applied to the oögonium like an accessory branch, with penetration tube.

1. Subfamily. Planoblastæ (Cystopodeæ).

Nonsexual reproduction by swarm spores. Sporangia, either persistent on mycelium or mostly falling as conidia and producing zoöspores in germination.

2. Subfamily. Siphoblastæ (Peronosporeæ).

Nonsexual reproduction by conidia, which germinate by germ tubes and are homologous to the falling zoösporangia of the Planoblastæ.

Under Archimycetes some general account is given of the group, including directions for collection and preparation of specimens. This is followed by a very convenient and useful key to the genera, 29 in all. The following genera and doubtful genera, including 144 good species and 39 doubtful ones, are described in these three numbers: Sphærita, Olpidium, Pseudolpidium (nov. gen. with figs.), Olpidiopsis, Pleotrachelus, Ectrogella, Pleolpidium (nov. gen. with figs.), Synchitrium, Woronina, Rhizomyxa, Rozella, Micromyces, Myzocytium, Achlyogeton, Lagenidium, Ancylistes, Resticularia, Rhizophidium, Rhyzidium, Rhizidiomyces, Achlyella, Septocarpus, Harpochytrium, Entophlyctis (nov. gen. with figs.), Rhizophlyctis (nov. gen. with figs.), Obelidium Chytridium, Polyphagus, Cladochytrium, Amœbochytrium, Catenaria, Hyphochytrium, Nephromyces, Aphanistis, Saccopodium, Zygochytrium, and Tetrachytrium. Only one new species is recorded, Olpidiopsis minor. The genera are illustrated by good figures and followed by a host index.

The treatment of the Zygomycetes is substantially the same as for the preceding series: first, fourteen pages outlining the main features of the order Mucorinæ, then a key to the genera, followed by a description of the species of the genus Mucor as far as the end of the first section, Mono-Mucor.

This volume, while devoted to the forms occurring in Germany, Austria, and Switzerland, can not fail to be of great service to American students, since many of the described species occur in this country. Reference to doubtful forms and extra-European ones also help to make the book indispensible.—ERWIN F. SMITH.

Fruit culture in foreign countries.—Reports from the consuls of the United States on fruit culture in their several districts in answer to a circular from the Department of State. Washington, Government Printing Office, 1890, pp. 391–937; Index, i–xiii.

This report is devoted principally to the citrous fruits, the olive, fig, and vine. Incidentally there are many references to the diseases of these plants, parasitic and nonparasitic. Some of the statements need to be taken *cum grano salis* because emanating from men not specially trained to observations of this kind, but on the whole the reports appear to be well written and will prove useful. A similar volume on the stone fruits of the world would be equally valuable.—ERWIN F. SMITH.

MANGIN, LOUIS.—(1) *Sur la callose, nouvelle substance fondamentale existant dans la membrane.* Comptes Rendus, Paris, tome CX, 24 Mars, 1890, p. 644.

(2) *Sur les réactifs colorants des substances fondamentales de la membrane.* Comptes Rendus, Paris, tome CXI, 15 Juillet, 1890, p. 120.

(3) *Sur la structure des Péronosporées.* Comptes Rendus, Paris, 15 Décembre, 1890, p. 923.

(4) *Sur la désarticulation des conidies chez les Péronosporées.* Bull. de la Soc. Bot. de France. Comptes Rendus des Séances, Paris, 1891, tome 38, pp. 176–184, 232–236, pl. 4.

(1) The author distinguishes three fundamental substances in the cell walls of plants—pectin compounds, cellulose, and callose. The latter has been studied quite carefully, and is described as a new fundamental substance, known hitherto only from sieve tubes. Not having been able to isolate it in sufficient purity for a chemical analysis, the author confines himself to an account of its distribution in plants.

Callose is colorless and amorphous, insoluble in water, alcohol, and Schweizer's reagent,* even after the action of acids; very soluble in soda or cold caustic potash 1 to 100, soluble cold in sulphuric acid, chloride of calcium, and concentrated bichloride of tin; insoluble cold in the alkaline carbonates, and in ammonia, which swells it and gives it a gelatinous consistency. Besides aniline blue and rosolic acid†

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*Cuprammonia.

†Known also as corallin, aurin, peonin.